

Affirmation of Election

As provisionally elected by Applicants' representative, Walter W. Nielsen (not by Michael Smith as indicated in the Office Action of October 3, 2002) in a telephone conference with the Examiner on September 16, 2002, Applicants elect to prosecute Group I, comprising claims 1-29.

The non-elected claims 30-32 are hereby canceled. However, Applicants reserve the right to later file continuations or divisions having claims directed to the non-elected inventions.

Amendments to the Specification

Applicants have carefully reviewed and edited the entire specification for accuracy. Applicants have made several amendments to the specification to conform the written description to the drawings and vice versa. For example, on pages 8-9, the reference number for "particles" has been changed from "116" to "120" to conform the description to FIG. 5, and on pages 10-11, the reference number for "pads" has been changed from "122" to "112" to conform the description to FIG. 6. No new matter has been added by way of these amendments to the specification.

Applicants have also made several other amendments to the specification by substituting "embodiments of the invention", "subject matter", or "disclosure" for "invention". This is because Applicants do not wish the claims to be interpreted as being limited to a single "invention". No new matter has been added by way of these amendments to the specification.

Amendments to Claims 1, 3-6, 8-10, 12, 17, and 22-29

Each of original claims 1, 3-6, 8-10, 12, 17, and 22-29 has been amended. No new matter has been introduced.

Certain of the amendments to the claims are made to satisfy Applicants' preferences, not necessarily to satisfy any legal requirement(s) of the patent laws, and they are not intended to limit the scope of equivalents to which any claim element may be entitled.

In independent claims 1 and 22, the limitation "no-flow" has been deleted. The language "over a plurality of pads" has been added. The language "component-mounting" has been

substituted for “component mounting”. The language “underfill material comprising a filler material containing particles” has been added. The particles are described as “potentially inhibiting a suitable connection between corresponding terminals and pads unless the particles are substantially removed”. Support may be found, for example, in the original written description on page 8, lines 6-10.

Further in independent claim 1, the language “and to substantially remove the particles from between corresponding terminals and pads” has been added. Additionally, the language “melt solder situated between the pads and the terminals, which when cooled results in a suitable electrical and mechanical connection between corresponding terminals and pads” has been added. Support may be found, for example, in the original written description on page 10, beginning line 27 and on page 11, lines 17-20.

Further in independent claim 22, the language “and to remove substantially all potentially inhibiting particles from between corresponding terminals and pads” has been added. Further, the language “and applying suitable heat to harden the underfill material” has been deleted. Support may be found where mentioned above, as well as on page 11, lines 20-21.

In dependent claims 3-5, the language “underfill material comprises a” has been deleted, and the language “is suitable” has been added.

In dependent claims 6 and 26, the language “underfill material comprises a” has been deleted, and “consisting of” has been substituted for “comprising”.

In dependent claim 8, the language “underfill material comprises filler” has been deleted, and “have” has been substituted for “having”.

In dependent claim 9, the claim dependency has been amended from claim 8 to claim 1, and the word “filler” has been deleted.

In dependent claims 10 and 12, “consisting of” has been substituted for “comprising”.

In dependent claim 17, “one of” has been substituted for “apparatus from the group comprising”.

In dependent claims 23-25, the claim dependency has been amended from claim 22 to new claim 35, which will be discussed below.

In dependent claims 28-29, the claim dependency has been amended from claim 27 to

new claim 36, which will be discussed below. Further, in claim 29, “consisting of” has been substituted for “comprising”.

New Claims 33-45

New claims 33-45 have been added to provide Applicants with additional protection to which Applicants are entitled. No new matter has been introduced.

New dependent claim 33 recites that “in applying suitable heat, the underfill material is hardened”. Support may be found, for example, in original claim 1.

New dependent claim 34 recites that in applying suitable heat, the underfill material is completely hardened”. Support may be found, for example, in the original written description at page 7, lines 13-14.

New dependent claim 35 recites that the component package of claim 22 is “further fabricated by applying suitable heat to melt solder situated between the terminals and pads, which when cooled results in an electrical and mechanical connection between corresponding terminals and pads”. Support may be found, for example, in original claims 13-15 and in the original written description at page 7, lines 11-13.

New dependent claim 36 recites that the electronic assembly of claim 27 is “further fabricated by applying suitable heat to melt solder situated between the terminals and pads, which when cooled results in an electrical and mechanical connection between corresponding terminals and pads”. Support may be found, for example, in original claims 13-15 and in the original written description at page 7, lines 11-13.

New independent claim 37 recites an electronic assembly comprising *inter alia* “a hardened underfill encapsulating terminals, pads, and connections”. Further, the underfill is described as having “a plurality of particles in the underfill, except that substantially no particles are in the connections, wherein the particles are of such size and composition as to potentially inhibit suitable connections between corresponding terminals and pads if particles are in the connections”. Support may be found, for example, in the original written description on page 8, lines 6-10; on page 10, beginning line 27; and in FIG. 7.

New dependent claims 38 and 39 are similar to original dependent claims 8 and 9, respectively.

New dependent claim 40 is similar to original dependent claim 6, except that ceramic oxide and ceramic nitride have been added to the Markush group. Support for the latter two materials may be found, for example, in the original written description on page 8, lines 28-29.

New independent claim 41 recites a method comprising *inter alia* “depositing a no-flow underfill material over a plurality of pads in a component-mounting area of a substrate, the underfill material comprising a fluxing filler material containing particles”. The method further comprises “applying suitable heat for the fluxing filler material to clean surfaces of the terminals and pads to be subsequently joined by solder”. The method further comprises “applying suitable pressure to cause the terminals to physically contact the pads and to remove substantially all potentially inhibiting particles from between corresponding terminals and pads”. Support may be found, for example, in FIGS. 8A-B and in the corresponding original written description beginning on page 11, line 23.

Dependent claim 42 recites that the operations of claim 41 are performed in a different order. Support may be found, for example, on page 14, lines 15-16.

Dependent claim 43 recites that “before placing the component, heat is applied to the component to raise its temperature to soaking temperature. Support may be found, for example, on page 12, lines 19-20.

Dependent claim 44 recites “applying suitable heat to melt solder situated between the terminals and pads, which when cooled results in a suitable electrical and mechanical connection between corresponding terminals and pads”. Support may be found, for example, on page 11, lines 17-20.

Dependent claim 45 recites “applying suitable heat to melt solder situated between the terminals and pads, which when cooled results in a pre-attachment between corresponding terminals and pads”. Support may be found, for example, on page 13, lines 15-19.

Rejections Under 35 U.S.C. §102(e)

Claims 1, 2, 10, 16-18, 22, 23, 27, and 28 were rejected under 35 U.S.C. §102(e) as being anticipated by Goossen (U.S. Patent No. 5,975,408). Applicants do not admit that Goossen is prior art and reserve the right to swear behind Goossen as provided for under 37 C.F.R. §1.131.

Goossen discloses a technique for solder bump bonding in which an underfill is applied to the surface of an interconnection substrate prior to solder bump bonding. The underfill is cured in the same heating step used to effect thermocompression bonding of the solder bumps. Refer to the Abstract.

Goossen does not disclose all of the limitations recited in independent claims 1, 22, and 27, as amended.

For example, regarding independent claim 1, Goossen fails to disclose an underfill material comprising particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor does Goossen disclose applying suitable pressure to cause the terminals to physically contact the pads and to substantially remove the particles from between corresponding terminals and pads.

Regarding independent claim 22, Goossen fails to disclose a component package fabricated by depositing an underfill material comprising a filler material containing particles. Nor does Goossen disclose an underfill material in which the particles potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor does Goossen disclose applying suitable pressure to cause the terminals to physically contact the pads and to remove substantially all potentially inhibiting particles from between corresponding terminals and pads.

Likewise, regarding independent claim 27, Goossen fails to disclose the use of an underfill comprising a filler material containing particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor does Goossen disclose applying suitable pressure to cause the terminals to physically contact the pads and to remove substantially all potentially inhibiting particles from between corresponding terminals and pads.

For the above reasons, independent claims 1, 22, and 27 should be found to be allowable

over Goossen, and Applicants respectfully request that the rejection of claims 1, 22, and 27 under 35 U.S.C. §102(e) as anticipated by Goossen be withdrawn.

Claims 2, 10, and 16-18, which depend directly or indirectly from claim 1 and incorporate all of the limitations therein, are also asserted to be allowable for the reasons presented above. Applicants respectfully request that the rejection of claims 2, 10, and 16-18 under 35 U.S.C. §102(e) as anticipated by Goossen be withdrawn.

Claims 23, which depends directly from claim 22 and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above. Applicants respectfully request that the rejection of claim 23 under 35 U.S.C. §102(e) as anticipated by Goossen be withdrawn.

Claims 29, which depends directly from claim 28 and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above. Applicants respectfully request that the rejection of claim 29 under 35 U.S.C. §102(e) as anticipated by Goossen be withdrawn.

Applicants consider additional elements and limitations of the claims to further distinguish over Goossen, and Applicants reserve the right to present arguments to this effect at a later date.

Rejection of Claims 3-5 Under 35 U.S.C. §103(a) over Goossen and Wong

Claims 3-5 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goossen as applied to claim 1 above, and further in combination with Wong et al. (U.S. Patent No. 6,180,696). Again, Applicants do not admit that Goossen is prior art and reserve the right to swear behind Goossen as provided for under 37 C.F.R. §1.131. The foregoing reservation applies to all of the rejections made by the Examiner under 35 U.S.C. §103.

Wong discloses an underfill material to which various additives may be added. The additives include a hardener, a curing accelerator, a fluxing agent, a viscosity agent, a coupling agent, and a surfactant. (See col. 3, lines 12-17.) The additives can also include a filler to obtain a low thermal coefficient of expansion. (See col. 14, lines 27-32.)

Goossen was discussed previously.

The asserted combination of Goossen and Wong fails to teach or suggest all of the claim limitations present in independent claim 1, as amended, so a *prima facie* case of obviousness has not been established.

For example, neither Goossen nor Wong disclose an underfill material comprising particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor do Goossen or Wong disclose applying suitable pressure to cause the terminals to physically contact the pads and to substantially remove the particles from between corresponding terminals and pads.

For the above reasons, claim 1, as well as all claims dependent therefrom, including claims 3-5, should be found to be allowable over any combination of Goossen and Wong, and Applicants respectfully request that the rejection of claims 3-5 under 35 U.S.C. §103(a) as being unpatentable over the combination of Goossen and Wong should be withdrawn.

Rejection of Claims 6-9, 26, and 29 Under 35 U.S.C. §103(a)
over Goossen and Garrett

Claims 6-9, 26, and 29 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goossen as applied to claims 1, 22, and 29 and further in combination with Garrett (U.S. Publication No. 2002/0128354).

Garrett discloses encapsulation compounds that may include a silica filler. The silica may be spherical. Particle size may be from .5 microns to 40 microns. Silica may be in the range of 60-90% of the formulation. (Refer to Paragraphs 0009 and 0022.)

Goossen was discussed previously.

The asserted combination of Goossen and Garrett fails to teach or suggest all of the claim limitations present in independent claims 1, 22, and 27, as amended, so a *prima facie* case of obviousness has not been established.

For example, neither Goossen nor Garrett disclose an underfill material comprising particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor do Goossen or Garrett disclose applying suitable pressure to cause the terminals to physically contact the pads and to substantially remove

the particles from between corresponding terminals and pads.

For the above reasons, claims 1, 22, and 27, as well as all claims dependent therefrom, including claims 6-9, 26, and 29, should be found to be allowable over any combination of Goossen and Garrett, and Applicants respectfully request that the rejection of claims 6-9, 26, and 29 under 35 U.S.C. §103(a) as being unpatentable over the combination of Goossen and Garrett should be withdrawn.

Rejection of Claims 11-12 Under 35 U.S.C. §103(a)
over Goossen and Wong

Claims 11 and 12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goossen as applied to claim 1, and further in combination with Wong.

Goossen and Wong were discussed previously.

The asserted combination of Goossen and Wong fails to teach or suggest all of the claim limitations present in independent claims 1, as amended, so a *prima facie* case of obviousness has not been established.

For example, neither Goossen nor Wong disclose an underfill material comprising particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor do Goossen or Wong disclose applying suitable pressure to cause the terminals to physically contact the pads and to substantially remove the particles from between corresponding terminals and pads.

For the above reasons, claims 1, as well as all claims dependent therefrom, including claims 11-12, should be found to be allowable over any combination of Goossen and Wong, and Applicants respectfully request that the rejection of claims 11-12 under U.S.C. §103(a) as being unpatentable over the combination of Goossen and Wong should be withdrawn.

Rejection of Claims 13-14, 19-21, and 25 Under 35 U.S.C. §103(a)
over Goossen and Saitoh

Claims 13-14, 19-21, and 25 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goossen as applied to claims 1 and 22 and further in combination with Saitoh et al. (U.S.

Patent No. 6,229,220).

Saitoh discloses coating terminals of a component with two layers of solder having different melting points. (Refer to FIGS. 2A-2B and col. 4, lines 8-21.)

Goossen was discussed previously.

The asserted combination of Goossen and Saitoh fails to teach or suggest all of the claim limitations present in independent claims 1 and 22, as amended, so a *prima facie* case of obviousness has not been established.

For example, neither Goossen nor Saitoh disclose an underfill material comprising particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor do Goossen or Saitoh disclose applying suitable pressure to cause the terminals to physically contact the pads and to substantially remove the particles from between corresponding terminals and pads.

For the above reasons, claims 1 and 22, as well as all claims dependent therefrom, including claims 13-14, 19-21, and 25 should be found to be allowable over any combination of Goossen and Saitoh, and Applicants respectfully request that the rejection of claims 13-14, 19-21, and 25 under U.S.C. §103(a) as being unpatentable over the combination of Goossen and Saitoh should be withdrawn.

Rejection of Claims 15 and 24 Under 35 U.S.C. §103(a)
over Goossen and Anonymous

Claims 15 and 24 were rejected under 35 U.S.C. §103(a) as being unpatentable over Goossen as applied to claims 1 and 22 and further in combination with Anonymous (DERW 1988-255069).

Anonymous discloses a chip having a solder ball (D) and a substrate having a solder column (ABA').

Goossen was discussed previously.

The asserted combination of Goossen and Anonymous fails to teach or suggest all of the claim limitations present in independent claims 1 and 22, as amended, so a *prima facie* case of obviousness has not been established.

For example, neither Goossen nor Anonymous disclose an underfill material comprising particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor do Goossen or Anonymous disclose applying suitable pressure to cause the terminals to physically contact the pads and to substantially remove the particles from between corresponding terminals and pads.

For the above reasons, claims 1 and 22, as well as all claims dependent therefrom, including claims 15 and 24 should be found to be allowable over any combination of Goossen and Anonymous, and Applicants respectfully request that the rejection of claims 15 and 24 under U.S.C. § 103(a) as being unpatentable over the combination of Goossen and Anonymous should be withdrawn.

Patentability of New Claims 37-45

New independent claims 37 and 41, and the claims dependent therefrom, are asserted to distinguish over the art of record.

For example, none of the art of record discloses the limitation in new independent claim 37 of “a plurality of particles in the underfill, except that substantially no particles are in the connections, wherein the particles are of such size and composition as to potentially inhibit suitable connections between corresponding terminals and pads if particles are in the connections”.

Claims 38-40 are all dependent upon claim 37, and they should be allowable for the reasons presented above.

Regarding independent claim 41, none of the art of record discloses an underfill material comprising particles that potentially inhibit a suitable connection between corresponding terminals and pads unless the particles are substantially removed. Nor does any art of record disclose “applying suitable pressure to cause the terminals to physically contact the pads and to remove substantially all potentially inhibiting particles from between corresponding terminals and pads”.

Claims 42-45 are all dependent upon claim 41, and they should be allowable for the reasons presented above.

Documents Cited But Not Relied Upon For This Office Action

Applicants need not respond to the assertion of pertinence stated for the references cited but not relied upon by the Office Action, because these references are not made part of the rejections in this Office Action. Applicants are expressly not admitting to this assertion and reserve the right to address the assertion should it form part of future rejections.

Conclusion

Applicants respectfully submit that claims 1, 3-29, and 33-45 are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney Walter W. Nielsen at 602/298-8920 or the below signed attorney to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 29 day of January, 2003.

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